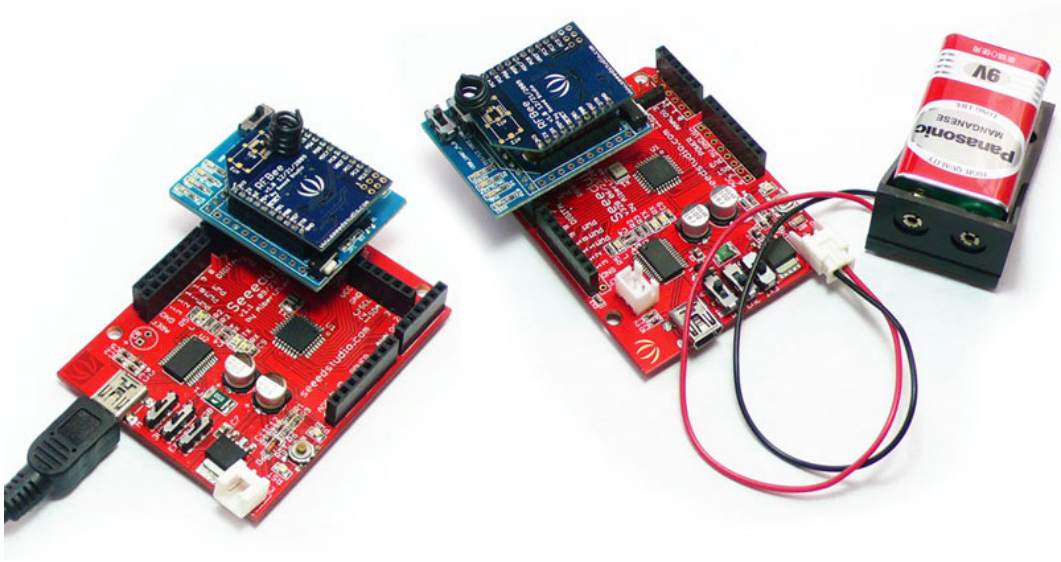
RFBee User Manual v1.0



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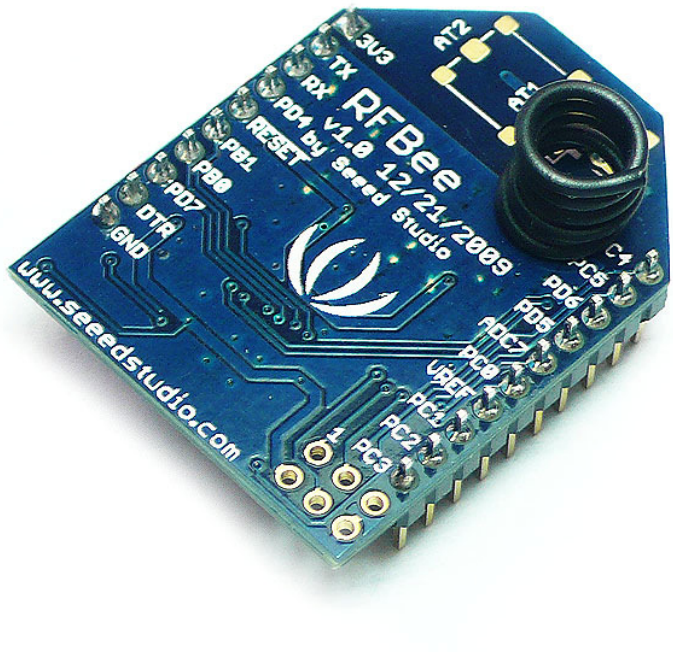
Overview



RFBee is a RF Module providing easy and flexible wireless data transmission between devices. You may reach most common RF module functionality via concise AT Command set. You may plug it into any Xbee socket for quick replacement, and it also have native AVR atmega168 working as a full functional Arduino.

- Indoor/Urban: up to 50m; Outdoor line-of-sight: up to 120m;
- Receiver Sensitivity: -95dBm
- RF Data Transmission Rate:1,200bps; 76,800bps
- Working Frequency : 868MHz~915MHz
- Communication type: Point to Point, or Point to Multipoint.
- Easy-to-Use Serial Interface and rich extendable ports
- Easy-to-Use AT Command: Set working mode, Serial Baud Rate, etc.
- Open source of Hardware and Firmware

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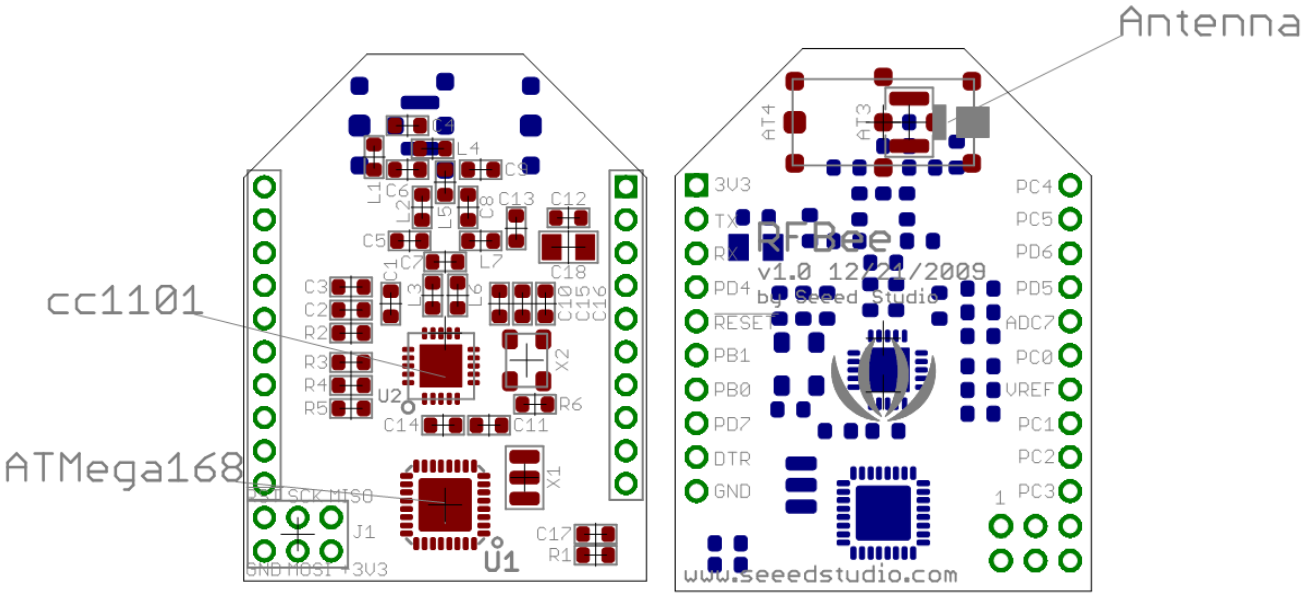
Specifications

Microprocessor	Atmega168
PCB size	24.38mmx32.94mmx0.8mm
Indicators	No
Power supply	+3.3v
IO counts	9
ADC input	2
Program interface	USB
Connectivity	Compatible with XBee
Communication Protocol	Uart
Operating Frequency Band	ISM 868MHz~915MHz
Outline Dimension	24.38mmx32.94mmx15mm

Electrical Characterstics

Specification	Min	Typ	Max	Unit
Input voltage	3	3.3	3.6	VDC
Transmit Current		34.5		mA
Receive Current		18.1		mA
Idle Current		5.2		mA
Power-down Current		<1		uA
Operating Temperature	-50		125	℃

System Block Diagram



Microprocessor-Atmega168

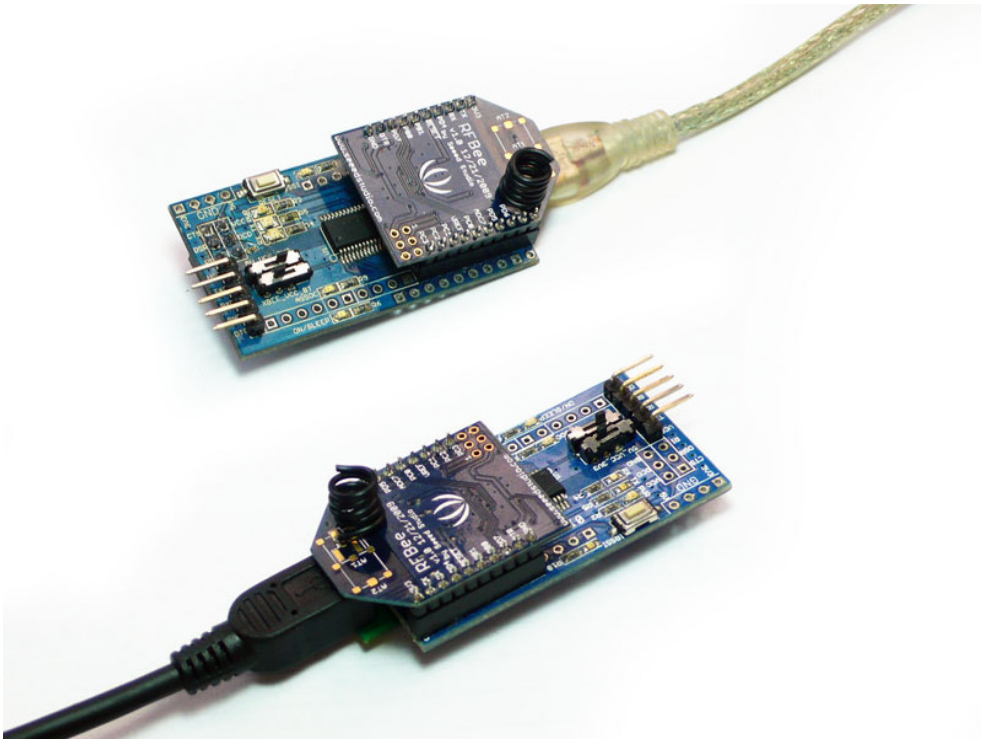
Atmega 168 has enough resources to implement the RF controlling while providing complete Uart communication. More importantly they are the most popular MCU among open source hardware community, making it compatible to Arduino IDE and the vast knowledge pool.
>>Datasheet: http://www.atmel.com/dyn/resources/prod_documents/doc2545.pdf

RF Transceiver-CC1101

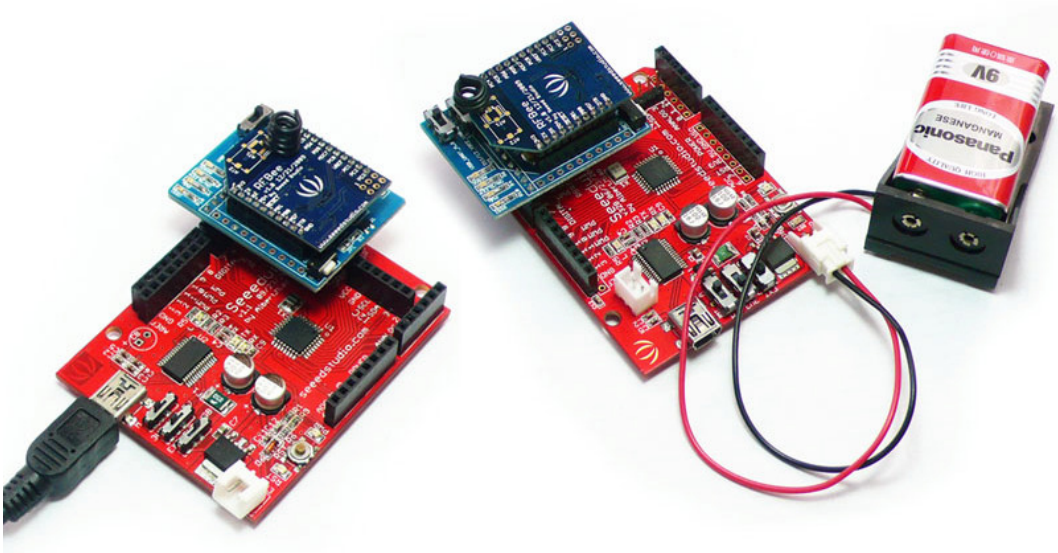
The CC1101 is a low-cost sub-1 GHz transceiver designed for very low-power wireless applications. The circuit is mainly intended for the ISM (Industrial, Scientific and Medical) and SRD (Short Range Device) frequency bands at 315, 433, 868, and 915MHz.
>>Datasheet: http://focus.ti.com/docs/prod/folders/print/cc1101.html

Hardware Installation

RFBee controlled by Hyperterminal on PC through UartSB.



RFBee controlled by Seeeduino through XBeeShield.



Software Installation

How to Make It Work

When powered on, RFBee will send "ok" through serial port. The default working mode is IDLE, so if you want to communicate between two RFBees, you need first to configure them into TRANS, RECV, or TRANSV mode.

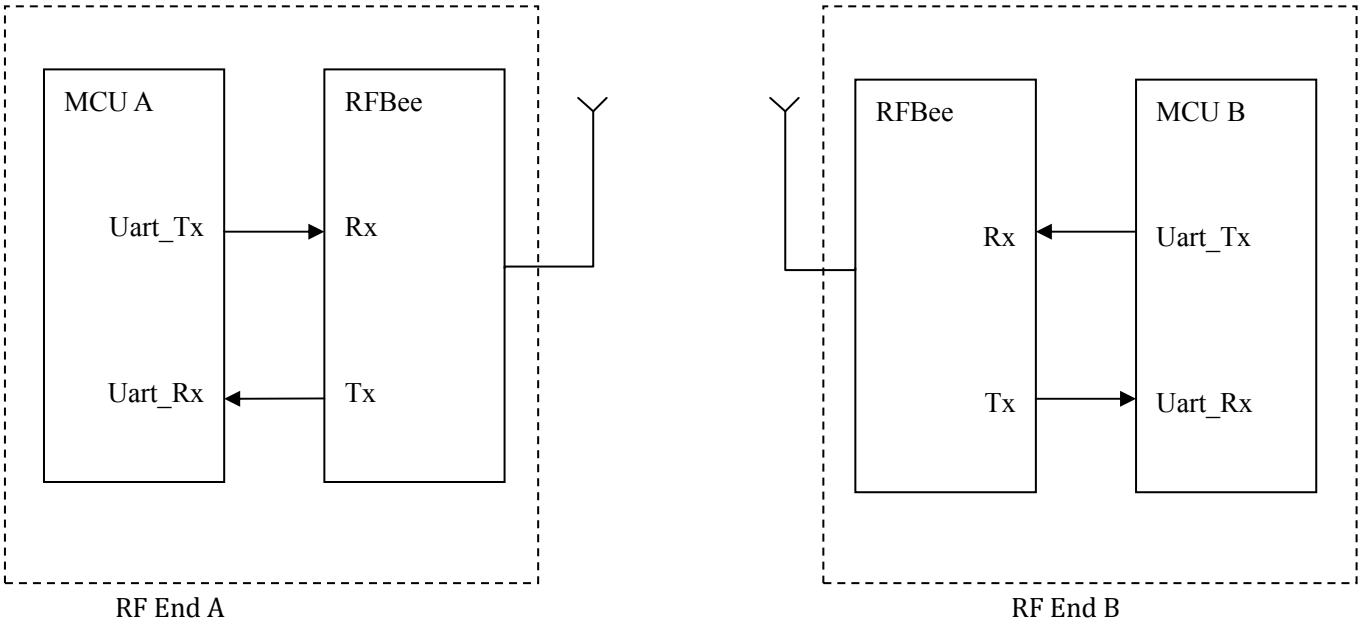


Figure 3 Two RF Ends using RFBee

Example

1. Make both RF End A and B work in Transv Mode

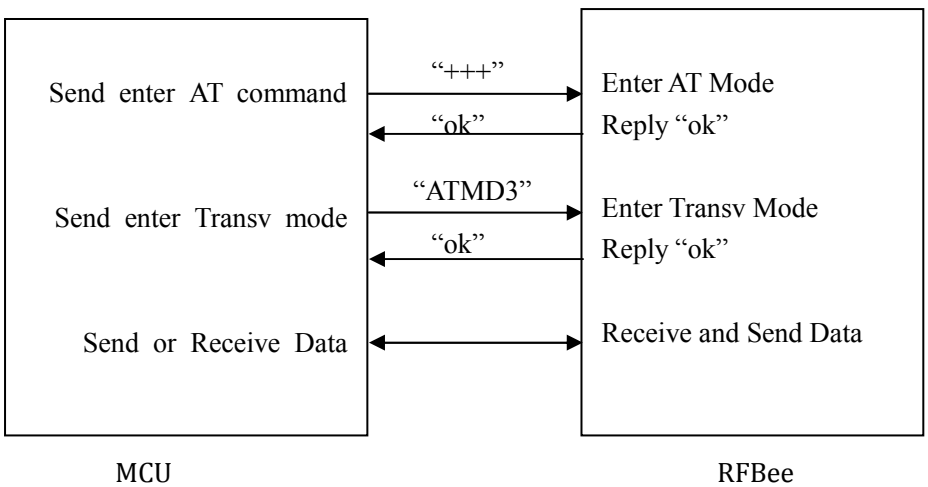


Figure 4 Make two RFBee work in Transv Mode

Step1: MCU sends "+++" to RFBee, and RFBee enters AT command mode whenever it receives "+++". If right, it will reply with "ok", otherwise with "error".
Step2: After receiving "ok", MCU sends "ATMD3" to RFBee to make it into Transv mode. If right, it will reply with "ok", otherwise with "error". Also you can do some other configurations using the AT command before into Transv mode.
Step3: After receiving "ok", MCU of RF End A can sends or receives data to or from RF End B. The received data package format is shown in the next section.

2. Make RF End A work in Trans Mode and RF End B in Recv Mode

For RF End A:

Step1: MCU sends "+++" to RFBee, and RFBee enters AT command mode whenever it receives "+++". If right, it will reply with "ok", otherwise with "error".
Step2: After receiving "ok", MCU sends "ATMD1" to RFBee to make it into Trans mode. If right, it will reply with "ok", otherwise with "error".
Step3: After receiving "ok", MCU can sends data to RFBee End B through Uart.

For RF End B:

Step1: MCU sends "+++" to RFBee, and RFBee enters AT command mode whenever it receives "+++". If right, it will reply with "ok", otherwise with "error".
Step2: After receiving "ok", MCU sends "ATMD2" to RFBee to make it into Recv mode. If right, it will reply with "ok", otherwise with "error".
Step3: After receiving "ok", MCU can receives data from RFBee End A through Uart.

Received Data Package Format:

length	dstAddr	srcAddr	Payload	RSSI

length = dstAddr(1 byte)+srcAddr(1byte)+payload(nbyte)+RSSI(1byte)

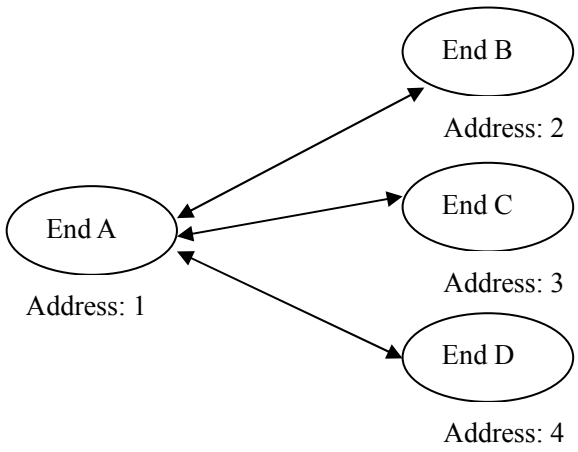
dstAddr:
When address check is applied (ATAC1), dstAddr is used by RFBee to compare with address of itself. If they are equal, RFBee will accept the package and then send it to MCU through Uart, otherwise the package will be dumped.
When address checking is not applied (ATAC0), RFBee will always accept the package whatever dstAddr is.

srcAddr:
Indicates the package is transmitted from which RFBee.

Payload:
Data that you want to transmit.
Max payload length = 32;
Minimal payload length = 1 when threshold=0, otherwise payload length = threshold;

RSSI: Received Signal Strength Indicator. One byte signed data, unit dBm.

3. Make RF Ends work in Point-to-Mutipoint.



For End B, C, D:
Step1. Send "+++": Make RFBee into Command mode;
Step2. Send "ATAC2": Set Address check and with broadcast, so that it will accept packages with broadcast **dstAdress** 0x00.
Step3. For End B send "ATMY2" to set address '2'; For End C send "ATMY3" to set address '3'; For End D send "ATMY4" to set address '4';
Step4. Send "ATDT1" to set address of destination '1'.
Step5. Send "ATMD3": Make RFBee into Transv mode;

For End A:
Step1. Send "+++": Make RFBee into Command mode;
Step2. Send "ATAC1": Set Address check, no broadcast.
Step3. Send "ATMY1": Set address of itself '1';
Step4. Send "ATDT0": Set a broadcast address, which means data transmitted from End A can be accepted by End B, C, and D.
Step5. Send "ATMD3": Make RFBee into Transv mode;

AT Command

AT Format:

AT + Comand(ASCII) + parameter(optional, character)

Example:
ATBD1 - Set Uart Baudrate of RFBee to 19200, return "ok" if success, otherwise "error".
ATBD - Get Uart Baudrate of RFBee, return "19200" and "ok" if success, otherwise "error".

Supported command:

Command		Parameter (character)	Specification	Default	Type
Adressing	AC	0-1	Set whether RFBee checks the incoming packet address or not. 0:No address check 1:Address check, no broadcast 2:Address check and 0(0x00)broadcast	0	r/w
	MA	0-255	Set RFBee itself address (return parameter in hex).	0	r/w
	DA	0-255	Set specific address of RFBee whose package can be accepted (return parameter in hex).	0	r/w
Power Amplifer	PA	0-7	Set RF transmitting power. 0:-30dBm,1:-20dBm,2:-15dBm,3:-10dBm, 4:0dBm,5:5dBm,6:7dBm,7:10dBm	7	r/w
UART	BD	0-3	Set Uart Baudrate of RFBee. 0: 9600bps,1: 19200bps,2: 38400bps,3: 115200bps	0	r/w
Working Mode	MD	0-5	Set working mode of RFBee. 0: idle mode,1: trans mode,2: recv mode,3: transcv mode,4: sleep mode,5: command mode	0	r/w
Transmitting Threshold	TH	0-32	Set threshold that will trigger RFBee starting to transmit (return parameter in hex). 0: transmit as soon as RFBee receive data from MCU.	4	r/w
RF DataRate	DR	0-1	Set RF transmitting DataRate. 0: 76800bps,1: 1200bps	0	r/w
Restore Default Settings	RS	-	Restore parameters into default settings.	-	r
Version	FV	-	Firmware version	v1.0	r
	HV	-	Hardware version	v1.0	r

Note*:*

1. ***When RF DataRate is 1200bps, the minimal transmit interval is about 1ms,;***
2. ***The best way to make RFBees work steady is to make them work in trans or recv mode, as it may drop some packages in transv mode sometimes.***

How to Update Firmware through Arduino

1. Connect RFBee to UartSB, move switches to XBee and 3.3v, then connect it to your computer through USB cable. UartSB link: http://www.seeedstudio.com/depot/uartsb-v22-a-much-more-powerful-usb-to-serial-converter-p-495.html?cPath=35
2. Download the source code of RFBeev1.0, decompress it to your working directory. http://www.seeedstudio.com/depot/datasheet/RFBEE.rar
3. Modify the Arduino library. Enter your Arduino installation directory (if you use Arduino 0017): ..\arduino-0017\hardware\cores\arduino.
   Backup file HardwareSerial.cpp and HardwareSerial.h before do any changes on them. Then replace them with two new files downloaded from here. http://www.seeedstudio.com/depot/datasheet/HardwareSerial.rar
4. Open your Ardunio, open the RFBeev1.0 project. Select Tools->Board->Ardunio Pro or Pro Mini (3.3v, 8MHz) w/ATmega168. Choose the recognized serial port, and then you can program your RFBee firmware by yourself.

Pinout

PIN	#	Pad Type	Description
3V3	1	Supply input	Vcc,+3.3v
TX	2	Output	Uart Tx port
RX	3	Input	Uart Rx port
PD4	4	Input/Output	ATmega168 PD4
!RESET	5	Input	ATmega168 Reset port
PB1	6	Input/Output	ATmega168 PB1
PB0	7	Input/Output	ATmega168 PB0
PD7	8	Input/Output	ATmega168 PD7
!DTR	9	Input	Used for programming ATmega168
GND	10	GND	GND
PC3	11	Input/Output	ATmega168 PC3
PC2	12	Input/Output	ATmega168 PC2
PC1	13	Input/Output	ATmega168 PC1
VREF	14	Input	ATmega168 AREF port
PC0	15	Input/Output	ATmega168 PC0
ADC7	16	Input	ATmega168 ADC7
PD5	17	Input/Output	ATmega168 PD5
PD6	18	Input/Output	ATmega168 PD6
PC5	19	Input/Output	ATmega168 PC5
PC4	20	Input/Output	ATmega168 PC4

Revision History

Rev.	Descriptions	Release date
V1.0	Initial design	2010/03/05
V1.01	Modify AT command DR and MD specifications	2010/03/15